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LYα EMITTERS AT $z \simeq 6$ IN THE OTELO SURVEY

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In this paper we discuss the detection of Lyα galaxies at $4.6 \lesssim z \lesssim 6.6$ within the OTELO survey. We estimate the expected number of objects that will be found in this survey.

One of the great challenges of observational cosmology is to detect the ancestors of normal present day galaxies (like our Milky Way) in the early universe which are in the stage of their first star formation. The detection of a wide spread population of these *primeval galaxies* would provide us with detailed information about several aspects of galaxy formation and would put strong constraints for models of galaxy and structure formation in the universe.

One could expect that the spectrum of a primeval galaxy may have similar features as giant HII regions in nearby galaxies. On the other hand, it is possible to model the evolution of stellar populations in galaxies (e.g. Charlot & Fall 1993) and the effects of intergalactic medium (Madau 1995) to predict spectral energy distributions of the high-redshift galaxies. There are three main spectral features of high-redshift, young galaxies: (a) strong Lyα emission; (b) a drop at the Lyman limit ($\lambda < 912$ Å; (c) a flat spectrum for $\lambda > 912$ Å(F_ν). Models predict that a young, dust-free, star-forming galaxy should show strong Lyα emission with equivalent widths of $50 - 250$ Å(Partridge & Peebles 1967; Meier 1976; Charlot & Fall 1993). The flux in the Lyα line should be $8-10$ times stronger than Hα and proportional to the SFR. On the other hand, due to resonant scattering, Lyα photons are absorbed by dust much heavily than continuum and Balmer photons. However, in the very first phase of star formation in galaxies, dust should not play a significant role implying that *strong Lyα emission is a criterion to select galaxies in the phase of forming their first generation of stars.*

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TABLE 1

ESTIMATED NUMBER OF LYα GALAXIES

λ range	7075-7205	8072-8247	9060-9300
Redshift	4.82-4.92	5.64-5.78	6.45-6.65
N(deg^{-2}/unit z)	25	2000	4500
Total emitters	45	285	160

Lyα emitters are also useful to investigate the physical properties of the intergalactic medium because the epoch of cosmic reionization (z_r) is considered to be close to redshifts $6-7$ (Djorgovski et al. 2001; Becker et al. 2001; Fan et al. 2001), where Lyα emission can be detected in the optical range.

Many attempts have been made to search for strong emission-line sources at high-redshifts (e.g. Pritchet 1994; Thompson et al. 1996) although most of these searches have failed. Exceptions include surveys around known high-redshift sources, such as quasars and radio galaxies (e.g. Hu & McMahon 1996; Keel et al. 1999). Recently, new attempts with 10m-class telescopes, using *narrow-band imaging* methods, have revealed the presence of Lyα emitters at high redshift (e.g. Cowie & Hu 1998; Hu et al. 1999; Steidel et al. 2000; Fujita et al. 2003, and many others).

OTELO (OSIRIS Tunable Emission Line Object Survey) is a survey that will use tunable filters to scan three spectral regions at resolutions of around 15Å at a limiting flux of $\sim 10^{-17}$ erg/s/cm^2. More than 8000 emission-line sources are expected (Cepa et al., 2003), mostly galaxies with Hα emission at redshift below 0.4. The observational technique will allow also to detect objects at higher redshifts with emission lines falling into these windows.

To estimate the number of primeval galaxies that OTELO would detect, we use the predictions of number counts by Thommes & Meisenheimer (1998) sketched in Figure 1. In this figure we have placed three points corresponding to the OTELO survey.

Table 1 shows the results of our estimation for each OTELO spectral window for the whole survey

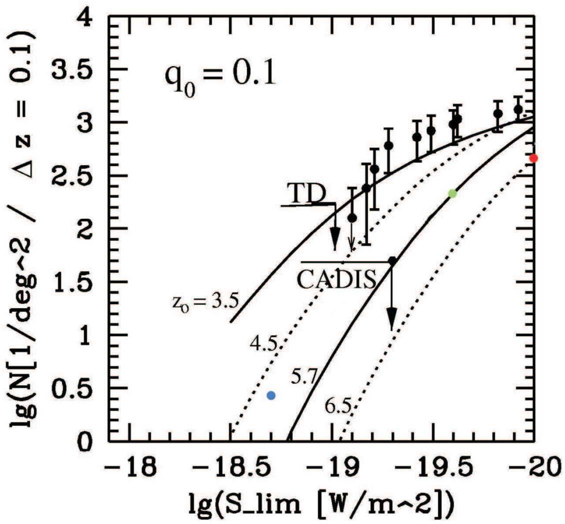

Fig. 1. Surface density of Lyα emitters at $z = 3.4$ by Cowie & Hu (1998) (points with error bars) together with the limits from CADIS ($z = 5.7$) and Thompson & Djorgovski (1995) (TD point). Lines at different redshifts are from models by Thommes & Meisenheimer (1998). Blue, green, and red dots mark the OTELO survey ($z \sim 4.9, z \sim 5.7, z \sim 6.5$)

($\sim$ 15 square degrees). OTELO will potentially find 490 high-redshift ($4.8 \lesssim z \lesssim 6.6$ Lyα) galaxies.

In summary, OSIRIS will offer the best tool to address the study of the population of primeval galaxies due to its large FOV, the large collecting area of the GTC telescope, and the availability of tunable filters. OTELO will allow us to determine luminosity functions, the space density, and the star formation rate of high-redshift galaxies. It will also put strong limits to models of galaxy formation and evolution.

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